Claims

1. Device for generating a thermal flux with magneto-caloric material (1-4), comprising at least one thermal flux generation unit (10, 30) provided with at least two thermal bodies (11, 21, 31, 41a, 41b) each containing at least one magneto-caloric element (12, 22, 32), magnetic means (103, 203, 303, 403) arranged to emit at least one magnetic field, displacement means coupled to the said magnetic means (103, 203, 303, 403) to move them relative to the said magneto-caloric elements (12, 22, 32) so as to subject the latter to a magnetic field variation in such manner as to vary their temperature, and means for the recuperation of the calories and/or frigories emitted by the said magneto-caloric elements (12, 22, 32), **characterized in that** the said displacement means reciprocate and are arranged to move the said magnetic means (103, 203, 303, 403) relative to the said magneto-caloric elements (12, 22, 32) in a reciprocating motion.

2. Device (1-4) according to Claim 1, **characterized in that** the said reciprocating movement is chosen from the group that includes at least pivoting, pivoting combined with translation, and translation.

3. Device (1-4) according to Claim 1, **characterized in that** the said recuperation means comprise at least one heat transfer fluid circuit (410a, 410b), means (411a, 411b) for circulating said heat transfer fluid in said circuit (410a, 410b) and means (413a, 413b) for extracting said calories and/or frigories recovered by said heat transfer fluid, the said circuit (410a, 410b) comprising at least two transfer zones (14) each located immediately adjacent to one of said magneto-caloric elements (12, 22, 32) and arranged so that said heat transfer fluid recovers, at least in part, said calories and/or frigories emitted by the said corresponding magneto-caloric element (12, 22, 32).

4. Device (1-4) according to Claim 3, **characterized in that** the said recuperation means comprise means for reversing the circulation direction of said heat transfer fluid in said heat transfer fluid circuit (410a, 410b).

5. Device (1-4) according to Claim 3, **characterized in that** the said recuperation means comprise at least two circuits (410a, 410b), at least one being a "hot circuit" (410a) for the calories and at least one being a "cold circuit" (410b) for the frigories, and commutation means (412) arranged so as to connect each transfer zone (14) in alternation to one or other of said circuits (410a, 410b).

6. Device (1-4) according to Claim 5, **characterized in that** it comprises synchronization means arranged to synchronize the said reciprocating displacement means with said commutation means (412) in such manner that, depending on the magnetic field to which each magneto-caloric element (12, 22, 32) is subjected, said corresponding transfer zone (14) is connected to one or other of said circuits (410a, 410b).

7. Device (1-4) according to Claim 1, **characterized in that** the said magneto-caloric element (12, 22, 32) comprises at least one magneto-caloric material chosen from the group that includes at least gadolinium (Gd), a gadolinium alloy containing at least one material chosen from the group that includes silicon (Si), germanium (Ge), iron (Fe), magnesium (Mg), phosphorus (P) and arsenic (As), said magneto-caloric material being in one of the forms chosen from the group that includes a block, a pastille, powder or an agglomerate of pieces.

8. Device (1-4) according to Claim 1, **characterized in that** each thermal body (11, 21, 31, 41a, 41b) is made at least in part from a conductive material selected for its good thermal conductivity and chosen from the group that includes at least copper and its alloys, aluminum and its alloys, steels and steel alloys, stainless metals and alloys thereof.

9. Device (1-4) according to Claim 1, **characterized in that** said thermal body (11, 21, 31, 41a, 41b) comprises at least one through-channel provided with at least one inlet orifice (16) and at least one outlet orifice (17) connected to said circuit (410a, 410b), said through-channel constituting the said corresponding transfer zone (14).

10. Device (1-4) according to Claim 1, **characterized in that** the said thermal body (11, 21, 31, 41a, 41b) comprises a single through-channel provided with a single inlet orifice (16) and a single outlet orifice (17) connected to said circuit (410a, 410b), said through-channel constituting the said corresponding transfer zone (14).

11. Device (1-4) according to Claim 1, **characterized in that** said magnetic means comprise at least one magnetic element (103, 203, 303, 403) provided with at least one permanent magnet or an electromagnet or a superconductor.

12. Device (1-4) according to Claim 11, **characterized in that** the said magnetic element (103, 203, 303, 404) comprises at least one magnetizable material arranged to concentrate and direct the field lines of said permanent magnet, and chosen from the group that includes iron (Fe), cobalt (Co), vanadium (V), soft iron, or a combination of those materials.

13. Device (1-4) according to Claim 11, **characterized in that** the said magnetic element (103, 203, 303, 403) has the shape of a U or C arranged to receive said magneto-caloric element (12, 22, 32) between its arms and in alternation.

14. Device (1-4) according to Claim 11, **characterized in that** the said thermal bodies (11, 21, 31, 41a, 41b) are independent and are separated by at least one thermally insulating element chosen from the group that includes at least a space or an insulating material.

15. Device (1-4) according to Claim 1, **characterized in that** it comprises a plurality of magnetic elements (103, 203, 303, 403) carried by at least one support (104, 304) coupled to said reciprocating displacement means.

16. Device (1, 2) according to Claim 15, **characterized in that** said support is essentially circular and constitutes at least one ring (104) mounted to pivot in reciprocation about its axis, said ring carrying the magnetic means (103, 203) radially, **and in that** the said thermal bodies (11, 21) define

circular sectors arranged in sequence essentially in a circle to be able to be straddled freely by said magnetic means (103, 203).

17. Device (1) according to Claim 16, **characterized in that** the said magnetic means (103) are orientated so that the gaps of the said U or C shapes are essentially parallel to said ring (104), **and in that** the said thermal bodies (11) are orientated essentially parallel to the pivoting axis of said ring (104).

18. Device (2) according to Claim 16, **characterized in that** the said magnetic means (203) are orientated so that the gaps of the said U or C shapes are essentially perpendicular to the pivoting axis of said ring (204), **and in that** the said thermal bodies (21) are orientated essentially perpendicularly to the pivoting axis of said ring (204).

19. Device (3) according to Claim 15, **characterized in that** the said support is essentially rectilinear and defines at least one bar (304) that moves in reciprocating rectilinear translation, said bar (304) carrying said magnetic means (303), **and in that** the said thermal bodies (31) are carried by at least one frame (306) positioned around the said bar (304) and are arranged essentially in line so that they can be straddled freely by said magnetic means (303).

20. Device (3) according to Claim 19, **characterized in that** the said magnetic means (303) are positioned in a staggered arrangement on either side of said bar (304) forming two rows, **and in that** the said frame (306) comprises two series of thermal bodies (31) each of which corresponds to the magnetic means (303) of one of the said rows.

21. Device (1-4) according to Claim 1, **characterized in that** at least part of the said thermal bodies (11, 21, 31, 41a, 41b) is carried by at least one plate (18, 28), which comprises communication orifices (100) to allow passage of said heat transfer fluid to said circuit (410a, 410b).

22. Device (1-4) according to Claim 3, **characterized in that** the said circulation means are

chosen from the group that includes at least a pump (411a, 411b), a circulator or a thermosiphon.

23. Device (1-4) according to Claim 4, **characterized in that** the said extraction means comprise at least two exchangers, of which at least one is a calorie exchanger (413a) connected to the "hot circuit" (410a) and at least one is a frigorie exchanger (413b) connected to the "cold circuit" (410b).

24. Device (1-4) according to Claim 1, **characterized in that** the said reciprocating drive means are chosen from the group that includes at least a motor, a jack, a spring mechanism, an aerogenerator, an electromagnet or a hydrogenerator.

25. Device (1-4) according to Claim 1, **characterized in that** it comprises a plurality of thermal flux generation units connected in series, in parallel or in a series-parallel combination.